pH SURVEY FOR TOMATOES

By
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As most of you gentlemen know, this survey was instigated shortly after I came on the job, in cooperation with NCA's National pH Survey. The necessity for this work was brought about by the California tomato processors petitioning the Food and Drug Administration for a revision of the Standard of Identity for whole tomatoes. Due to the relatively high pH values, they were trying to have citric acid added to the list of optional ingredients. Due to the feeling of the canners in the Mid-west and Tri-state areas, NCA thought it advisable to conduct an extensive survey to determine the advisability of the proposed amendment.

We in Ohio decided upon a schedule whereby plants in the major tomato area would be visited once a week during the processing season to make pH determinations. The Tip Top, Bryan, and Gypsum Canning Companies consented to allow us to use their facilities. The survey started during the second week of the season and was continued for the next five consecutive weeks. Two plants were missed during the weekly visits, so a total of 13 plant checks were made, with a total of 1,300 tomatoes being checked.

The procedure for analyzing the tomatoes was the same for each plant. A hamper of tomatoes was selected at random from a grower's load as it was ready to unload at the plant. The variety and the name of the grower was recorded for each sampling. The individual tomatoes were analyzed just as they came from the hamper, with no previous sorting or grading. The tomatoes were first halved and the color determined by an Agtron E colorimeter. The juice was then extracted from the individual tomatoes and the pH determined by a Beckman pocket pH meter. Total acid was calculated by titrating the tomato juice with 0.1 N NaOH to a given pH on the pH meter. Notations were also made if the tomatoes had any mold or rot present.

Table I is a general summary of the data obtained in the complete survey. The pH, per cent total acid, and Agtron E values are all averages obtained from the total 100 samples of tomatoes. The 1.4 sigma value represents the two extremes where 84% of the individual pH's for that particular sampling fall. The range values represent the high and low pH values for that particular sampling. Looking first at the pH values, it is quite apparent that there is a marked pH increase in the last six sampling dates. The pH values obtained for the first sampling date might not have been indicative of all the tomatoes being received at that particular plant on that particular day. I observed the load from which this sample was taken, and there were a greater number of 2's and culls than the average loads being received. The rest of the samples obtained during the season seem to be a fair representation of the raw product quality being run at the plant on the day of sampling.

By comparing the figures in the 1.4 sigma column with the figures in the range column you can tell whether the majority of the tomatoes were grouped or whether there was a considerable spread as to their pH values. It might also be noted that even though the pH's were high on a particular sampling date, the upper range limit is not as high as might be expected. You will also note the

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upper limit for the 1.4 sigma value is usually higher in these instances, thus indicating the pH increase was not due merely to a few samples. The total acid figures will also show a corresponding decrease where the pH values are above normal. As might be expected, even though not 100%, the Agtron E values indicate better color as pH's rise. However, the amount of color change, which is an index of maturity, is not great enough to account for the wide variation in pH's.

Table II gives a quality comparison of the sound and unsound fruits as they appear in the survey. The first major heading represents average values of the total 100 fruits per sampling. The second heading contains the average values obtained from the sound or No. 1 quality tomatoes as far as defects are concerned. The third heading contains the average value of fruits that had some degree of rot or mold showing. The day after our survey started, Dr. Gould received information that Dr. Kramer and his associates at the University of Maryland had found an alarming increase in the pH of tomatoes that had rotten or moldy portions. They have also made figures available as to the chance of the pH in a can of tomatoes being above 4.5. Some of these figures are quite alarming. We have substantiated these earlier findings 100%. In every case the pH of the sound fruit is lowest, the pH of the composite sample intermediate, and the pH of the unsound fruit high. The relationship of the total acid and the Agtron E figures may also be correlated in the same manner, with the results being as expected. The total acid was low in the unsound fruit, and the color reading indicated more mature fruit.

A liberal interpretation of our results might indicate that California is packing rotten tomatoes. Needless to say, this is not the case. However, the results do show two very important things. One is that the pH levels in our state are all safe, provided the proper sorting and grading procedures are followed. The pH on all the samples was well below the danger point of 4.5. The second thing follows this, and it is the importance of doing a good job of sorting prior to processing. This is especially important when we think of filling a #303 can with two or three tomatoes and one of those tomatoes has a pH of 6.0. The whole can would be affected, thus raising the total pH of the can above the 4.5 level and causing a spoiled product.

The total survey might be summed up by saying Ohio does not need acidification of tomatoes to produce a product of high quality that is safe for consumers.

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TABLE I. ANALYSIS OF DATA OBTAINED IN pH SURVEY OF OHIO PROCESSORS - AVERAGE VALUES OBTAINED FROM 100 TOMATOES PER SAMPLING

CODE	VARIETY	DATE	pH	1.40-*	RANGE	% TOTAL ACID	AGTRON E**
212	Rutgers	8/18/59	4.37	4.01-4.72	4.00-6.10	.453	38.33
312	K.C. 146	8/19/59	4.23	4.03-4.42	3.98-4.73	.594	37.01
123	Rutgers	8/24/59	4.21	3.89-4.52	3.85-5.40	.667	50.89
223	Glamour	8/25/59	4.25	4.13-4.37	4.00-4.45	.503	33.77
134	K.C. 135	8/31/59	4.17	3.99-4.35	3.90-4.62	.513	50.74
234	Rutgers	9/1/59	4.19	4.06-4.32	3.97-4.60	.655	41.31
334	Jubilee	9/2/59	4.12	3.77-4.46	3.80-5.97	.832	49.53
145	Rutgers	9/8/59	4.34	4.16-4.51	4.00-4.80	.377	47.93
245	Garden State	9/9/59	4.26	4.03-4.49	3.95-4.80	.475	44.44
345	K.C. 146	9/11/59	4.39	4.19-4.58	4.00-4.63	.471	46.91
156	Rutgers	9/14/59	4.32	4.07-4.56	3.95-5.05	.471	51.02
256	Rutgers	9/15/59	4.31	4.12-4.49	3.95-4.80	.416	35.17
356	K.C. 146	9/17/59	4.39	4.18-4.60	4.15-4.90	.446	44.00

* 1.40- was calculated as outlined in OAES Research Bulletin 781 - A Study of Some of the Factors Affecting the Grade Relationship of Fresh and Processed Vegetables, by W. A. Gould.

** Agtron E - Lower values indicate better color.

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TABLE II. QUALITY COMPARISON OF THE SOUND AND UNSOUND FRUITS USED IN THE TOMATO pH SURVEY - AVERAGE BASED ON 100 TOMATOES FOR EACH SAMPLING.

			Total 100 Fruits			Sound Fruit			Rotten or Moldy Fruit			
CODE	VARIETY	DATE	pH	% TOTAL ACID	AGTRON E*	pH	% TOTAL ACID	AGTRON E*	% ROTTEN	pH	% TOTAL ACID	AGTRON E*
212	Rutgers	8/18/59	4.37	.453	38.33	4.31	.467	39.96	17	4.66	.376	31.58
312	K.C. 146	8/19/59	4.23	.594	37.01	4.21	.605	36.74	7	4.43	.448	40.57
123	Rutgers	8/24/59	4.21	.667	50.89	4.14	.697	51.85	18	4.47	.539	40.94
223	Glamour	8/25/59	4.25	.503	33.77	4.24	.515	35.90	21	4.26	.456	25.76
134	K.C. 135	8/31/59	4.17	.513	50.74	4.13	.965	52.92	18	4.33	.393	42.61
234	Rutgers	9/1/59	4.19	.655	41.31	4.18	.664	42.04	7	4.33	.530	34.42
334	Jubilee	9/2/59	4.12	.832	49.53	4.06	.875	50.58	15	4.48	.503	43.00
145	Rutgers	9/8/59	4.34	.377	47.93	4.31	.393	47.13	31	4.41	.337	47.51
245	Garden State	9/9/59	4.26	.475	44.44	4.22	.491	45.97	23	4.38	.434	39.30
345	K.C. 146	9/11/59	4.39	.471	46.91	4.35	.478	47.07	25	4.48	.433	44.56
156	Rutgers	9/14/59	4.32	.471	51.02	4.38	.490	52.39	14	4.56	.336	42.57
256	Rutgers	9/15/59	4.31	.416	35.17	4.28	.430	34.64	12	4.51	.343	40.25
356	K.C. 146	9/17/59	4.39	.446	44.06	4.31	.458	45.55	35	4.52	.421	41.29

* Agtron E - Lower values indicate better color.

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